

Open Research Online

The Open University's repository of research publications and other research outputs

Demand Responsive Transport: is Milton Keynes developing a post-Covid revolution in public transport?

Conference or Workshop Item

How to cite:

Potter, Stephen; Enoch, Marcus; Valdez Juarez, Alan and Cook, Matthew (2021). Demand Responsive Transport: is Milton Keynes developing a post-Covid revolution in public transport? In: Universities Transport Study Group Annual Conference, 5-6 Jul 2021, University of Loughborough [Online].

For guidance on citations see [FAQs](#).

© 2021 The Authors



<https://creativecommons.org/licenses/by-nc-nd/4.0/>

Version: Version of Record

Link(s) to article on publisher's website:
<http://utsg.net/annual-conference>

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data [policy](#) on reuse of materials please consult the policies page.

oro.open.ac.uk

Demand Responsive Transport: is Milton Keynes developing a post-Covid revolution in public transport?

Stephen Potter
Emeritus Professor of Transport Strategy
The Open University

Marcus Enoch
Professor of Transport Strategy
Loughborough University

Miguel Valdez
Lecturer in Technology Management and Innovation
The Open University

Matthew Cook
Professor of Innovation
The Open University

Abstract

Recently there has been a renewed interest in Demand Responsive Transport (DRT) and related service offerings as a system that can serve 21st century patterns of dispersed low-density travel. Numerous attempts have been made to introduce forms of DRT, but despite some limited applications, DRT has largely stalled amidst technological, regulatory, and economic barriers.

Significantly, the impetus for DRT is now from technology-led companies that have already impacted upon taxi operations and have ambitions to develop their products and markets taking them into mainstream public transport, and some more innovative UK authorities are developing partnerships with these new digital technology operators. This has been accelerated by the pandemic creating uncertainty about how public transport use will change, coupled with local authorities seeking economic and social recovery amidst financial pressures on public transport support.

This paper reports some results from an in-depth case study of one city's radical shift towards replacing conventional bus routes with DRT. This is the partnership between the commercial DRT operator, *Via*, and Milton Keynes Council. In autumn 2020 an area served by one Council supported bus route was converted to DRT and from April 2021 eleven other supported routes in Milton Keynes were replaced with DRT, run by *Via* and largely operated using electric vehicles. With a growing fleet of 26 vehicles covering the whole of Milton Keynes Borough, this represents the most widespread urban DRT application in the UK.

This paper draws on documentary evidence, operational data and in-depth interviews with key stakeholders, focussing on the operational, business and policy aspects of the system and how it may develop. Key public policy issues are identified in the cost-effective use of DRT, user adaptations and understandings needed, the partners and expertise required, and practices and relationships needed between actors for DRT to have a socially transformative effect on how public transport is provided and is used.

Introduction

Despite various government initiatives, bus passenger numbers in Britain have been steadily declining. In the ten years from 2009/10 to 2019/20, bus patronage fell by 13.5% from 5.2 billion to 4.5 billion with a 10.5% decline in revenue (DfT, 2020). This was even before the impact of the extended lockdowns due to Covid-19 from May 2020 when bus passenger numbers dropped to 15% of pre-pandemic levels in London and 10% elsewhere (DfT, 2021). By the end of May 2021, passenger numbers had returned to about 75% of pre-pandemic levels both in London and elsewhere, but the sector expects to recover only around 80% of

pre-pandemic journeys, whilst new modes such as Uber and e-scooters pose further long-term existential challenges. Outside of major urban areas, there is the possibility that within a decade buses could become largely irrelevant. Behind the decline in bus use is a core long-term structural problem of the scheduled bus service model. Fixed routes and schedules operate well along high density travel corridors, but, as noted in the report *All Change?* (Marsden et al., 2018), the major areas of travel growth are now for social and leisure-related purposes. Geographically, the strongest growth has not been along major corridors into city/town centres but in cross-suburban, urban fringe ('peri-urban') and in rural areas (Hall, 2013). The nature of our urban environments has changed and consequently so too has our mobility behaviour.

The local bus model of scheduled corridor services has become increasingly unable to accommodate this long-term shift in the socio-technical landscape (Potter et al 2021). Consequently, bus services have come to concentrate on markets that conform to their operating model, with a particular emphasis on commuting (which makes up 44% of bus trips compared to 15% of all trips) and shopping journeys, both of which are in decline - a decline that the pandemic appears to have accelerated.

The medium-term effects of the pandemic shock on top of already declining bus use are only just beginning to emerge. During the pandemic, special support for bus services were put in place (the COVID-19 Bus Services Support Grant and the Bus Service Operators Grant, DfT 2021a), but as these come to an end, bus operators are facing a more difficult business landscape. One consequence is that local authorities are anticipating a resultant increase in financial demands as some commercial bus services in their areas cease to be economically viable and a rise in subsidies are needed for their own supported services. Even before the pandemic, local authorities were facing difficulties in financing essential bus services (LGA 2018), and with post-pandemic public finance cuts in prospect, funds to support buses are set to be cut even further. This comes just as the economic impact of the pandemic results in many people needing to find new employment and make other adjustments to their travel behaviour.

In the middle of the 2021 lockdown, the government announced the new National Bus Strategy (DfT 2021a), which looks to local authorities entering into proactive partnerships with bus operators to substantially improve services and develop more environmentally sustainable travel behaviours. The National Bus Strategy considers that franchising and (in particular) enhanced bus partnerships could increase the quality and attractiveness of bus services. Integrated services and multi-modal tickets are particularly emphasised, together with increases in bus priority measures and high-quality information for passengers. Amidst this, the role of innovation is largely seen as applying greener vehicle technologies to buses. There is passing reference to demand responsive services, but these are presented as of marginal relevance "in lower-density, often rural areas" and to "improve evening and Sunday services in places which currently lack them, integrated with conventional buses during the day" (DfT 2021a: 13).

This paper reports and analyses some initial results from a scoping study on a much more innovative approach than anything envisaged in the National Bus Strategy. This is one that seeks a bus business model to match 21st century travel demands – not trying to get modern travel practices to conform to an early 20th century bus operating model. This raised the question that, rather than institutional reforms to the existing bus business model, might a different business model for buses be the key to transforming local public transport services? This study is of how one unitary local authority, Milton Keynes, has used an innovative approach focusing on demand responsive transport (DRT) that seeks to simultaneously achieve cost efficiency and transform service quality to make bus travel a viable option for a large segment of society. Could such an innovative approach represent an important contribution to enhancing the role of bus services in our post pandemic recovery?

Demand Responsive Transport

For many years it has been argued that Demand Responsive Transport (DRT) is well suited to modern patterns of travel demand. DRT is 'an intermediate form of public transport, somewhere between a regular service route that uses small low floor buses and variably routed highly personalised transport services offered by taxis' (Brake et al, 2004, p. 324). DRT

as a concept is theoretically appealing because it offers passengers an almost taxi-level service for the price of a bus ticket, whilst costing less to operate than a conventional (larger) bus. In practice however, (periodic resurgences aside), DRT has remained relatively niche as a public transport mode due to three particular barriers (Cervero, 1997; Enoch et al, 2004; Mulley, Nelson et al, 2012), namely technological, institutional and economic.

Recent experiences, however, seem to suggest that the technological barriers have largely been solved, whilst in many jurisdictions around the world the institutional hurdles have largely been sidestepped (albeit not actually removed in many cases) though it does seem that more information is needed on how services achieve financial viability (Perrera et al, 2020). Consequently, DRT looks set to move into the mainstream, with many new schemes proposed or launched in England (e.g. Ebbsfleet, West Yorkshire, Hertfordshire, Cambridgeshire, North Lincolnshire), Scotland (e.g. Aberdeenshire, Moray, South East Scotland), and Wales (e.g. Cardiff, Newport and North Wales) (various editions of Local Transport Today 2020-2021). Internationally, there have been numerous DRT trials and schemes. Bridj, Lyftline, UberPOOL and Via have operated in the United States, and in Europe examples include Abel in Amsterdam, Kutsuplus in Helsinki, Padam in Paris, and Radiobus di Quartiere in Milan among others (Alonso-Gonzalez et al 2018, Veeneman and Mulley 2018, Pettersson 2019).

This issue of financial viability stems from the fact that small vehicles generally struggle to generate sufficient revenue from the low numbers of passengers often paying relatively low fares to cover the high costs of provision (particularly the driver costs). In addressing this, Enoch (2021) noted how surviving DRT operations have looked to raise revenue and/or cut costs. Thus, commercially driven 'jitney-style' schemes on high-demand corridors aim to boost revenues by maximising ridership, often not even setting off until they are full, whilst airport shuttle operators charge fares between the public transport and airport taxi rates, so reflecting the intermediate quality of the service. Other mechanisms are to generate ancillary revenue streams (e.g. advertising), rely on local authority subsidies, or attract new monies from alternative external sources like employers. Cost cutting methods have included service rationalisation through reducing service levels (frequencies, switching from door-to-door to pickup and drop points). Another cost cutting approach has been the use of brokerage schemes to share access to vehicles between community transport, social services, education, public transport operators and voluntary groups. Finally, the back-office system is a major part of a DRT service, so technological solutions to minimise the staff needed to answer telephones, or shared service centres can address this.

Haglund et al (2019) stated that operators need to better understand the role of "operating zones, hours, and pricing schemes for static versus on-demand mobility services", as well as the "interdependencies between service demand, fare subsidizing, fleet utilization, operating revenue, service availability and pricing schemes" (pp.11). Meanwhile, Sharmeen et al (2020) applied a business model methodology and emphasised the importance of public sector operations becoming more client oriented; more focused on the need for value creation and eventually revenue generation, with public sector operators becoming less a provider and more of a facilitator. Similarly, Calvert et al (2019) stated new models of partnership working to be critical, but that there were often significant barriers to making this happen. Finally, Teal and Becker (2012) reported that "the public transport agencies in Denver and Dallas have adopted a strategy of carefully targeting customer-friendly flexible services to specific market segments while maintaining strict control of capacity. They have also competitively contracted these services to private operators—thereby keeping production costs at a low level— which would have been institutionally difficult if the services had been fixed route in nature" (pp64).

The targeting of DRT services raises the issue of how they affect the public transport system as a whole. Sharmeen et al (2020) notes: "One of the major motivations to move towards FPT (DRT) systems is to address the gaps in both service delivery and market share, e.g. in solving the low-demand fixed transit line issue or offering last mile solutions. However, it is yet unknown how the advent of a new distribution channel (i.e. the platform provider) would affect the traditional public transit supply chains? How would the stakes and revenues be re-arranged? General conjecture is that the public transport providers would be at the losing end of the bargain and end users would have to pay up – to what extent are these true".

To date, the reality in many areas is that establishing a scalable, sustainable business model for DRT remains elusive (Petterssen 2020, Sharmeen et al 2020), as is testified by recent failed schemes such as Charriot, Slide, Kutsuplus, Breng Flex, PickMeUp and Bridj.

The Milton Keynes DRT service is one that addresses many of the issues summarised above. The arrival of technology-based cab operators, such as Uber Lyft and Ola, with their App-based, automated algorithm booking systems has been exploited through a partnership with such a company to deliver a public transport service to address transport policy requirements. This is an important case of an enhanced bus partnership, but one that is very different to that envisaged in the conventional service constrained National Bus Strategy.

Methodology

This scoping study is in response to the opportunity provided by the rapid implementation in Milton Keynes of a comprehensive DRT network intended to substantially improve the quality and coverage of all public transport services in the area. Although it is important to gather and analyse quantitative operational and financial data, the focus of this study is on gathering detailed in-depth qualitative information on the factors leading to the schemes design and performance.

As well as documenting factors leading to the design, performance and transferability of this particular DRT programme, this research is intended to help identify what theoretical frameworks can help provide an understanding of the processes and relationships involved. For example, in an innovative context, the Multi-Level Perspective (MLP) could be used (Sharmeen and Meurs 2019) together with the related Strategic Niche Management theory to identify how long-term pressures from the Socio Technical Landscape lead to the need for innovation in public transport systems (Geels 2018:90). Niche innovations in DRT would be explored to develop understanding, but these would then have to move from experimental trials to establish a viable place within the public transport regime. That has been the core problem for DRT and is what the Milton Keynes programme is seeking to achieve.

The quantitative and qualitative data gathered in this study should therefore be able to be analysed using a range of theoretical perspectives to identify the sorts of understanding that each can provide.

This has led to a mix methods approach for the scoping study. Operational and monitoring quantitative data are gathered by the operator, Via, and Milton Keynes Council. These will be drawn upon, together with this project's qualitative in-depth interviews of key actors and informants involved in the DRT systems design, development and implementation. Key informant interviews will later be undertaken to obtain information on user perspectives, including the changes that DRT produces in the practices, behaviours and understandings needed.

Five in-depth interviews took place in May 2021 with people in Milton Keynes Council who developed the DRT service, with the operator Via, who successfully tendered to run the service, and with others who played a part in developing Milton Keynes public transport vision (which also includes some of the authors of this paper). The interviews were conducted online, using MS Teams, under protocols established by the Open University Research Ethics Committee. The following text incorporates the results of these interviews, together with material gathered from research and operational sources.

DRT in Milton Keynes

DRT featured early in the development of Milton Keynes when a 'Dial-a-Bus' operated between 1975-78, serving the scattered developing estates in the Woughton area (Bendixon and Platt 1992 :159-60). This was popular but proved too expensive to continue; it shifted to a semi-scheduled and then a conventional minibus service. Post bus deregulation in 1986, the Development Corporation and Milton Keynes Council were required to leave bus service development to the private sector (ibid). As the population of Milton Keynes grew, bus services did expand, but Milton Keynes dispersed car-oriented urban design meant that service levels remained poor for the emerging city of 250,000 people. Broadly a pattern of services developed that was fairly typical of medium sized British provincial cities, with a limited commercial bus network run by a dominant operator (in Milton Keynes it is Arriva), with smaller local companies tendering for council supported services. About 85% of bus trips are on the commercial services and 15% on the supported services. The urban supported services typically ran at an hourly frequency, with rural services often two-hourly. By 2019 Milton Keynes had 10 commercial bus routes and 11 routes of supported services, plus a number of other inter-town services that ran into Milton Keynes (including Stagecoach's longer distance Oxford-Cambridge X5).



Fig 1: The 1975 Milton Keynes Dial-a-Bus

Since 2000, Milton Keynes Council has played a very active role in transport innovation (including EV charging infrastructure, a commercial eBus, autonomous pod trials, autonomous vehicle deliveries and city bike and eScooter schemes). They established a management structure within the Council that supports such initiatives with a specialist transport innovation function separate from transport planning and a close integration of its transport functions. For many years, recognising the inadequacy of its supported services, Milton Keynes Council has been looking for ways to sustainably introduce a DRT system. They wished to avoid the short-term funded project model that had seen so many DRT schemes fold when the project funds ended. As such they sought a partnership with providers who were establishing technology-led cab and DRT systems that could potentially be run in Milton Keynes without depending on a new ongoing subsidy and could be funded from established sources. Discussions opened with Simply Connect and Arriva Click, but neither provided a cost-effective basis for the sort of service desired.

When *Via* (then called *Via Van*) expressed interest in establishing a commercial DRT service in Milton Keynes, the Council recognised there was the opportunity to explore DRT concepts with them. *Via*'s own commercial DRT service became established in 2017-18, offering a fare midway between that of a cab and the bus for its on-demand, app-booked shared van service. It competed with both the bus and cabs, offering shared trips between local neighbourhood pickup and dropping off points. In 2018 Milton Keynes Council and *Via* ran a trial project to explore how the *Via* service could be integrated with concessionary fares. This was part of developing knowledge and understanding of how a commercial DRT model could be adapted to fulfil the requirements of a public transport system. A commercial DRT service can focus on a particular market segment to the exclusion of others. By way of contrast, anything provided or supported by a local authority needs to be an inclusive form of public transport, being able to accommodate (as conventional buses do) wheelchair users and accept a range of ticketing types such as for concessionary fares for seniors and for students. The concept emerged of not just treating the supported services in isolation, but to use an innovative approach that would also support



Fig 2: A Via Van in commercial service in Milton Keynes in 2019

conventional commercial bus operations and produce an overall system that enhanced greener transport options as a whole.

A second, and crucial, point was that the costs of supported services were rising for what was an extremely basic set of both urban and rural bus routes operated by a mix of small local operators. The supported services cost £2.8m per annum and these costs were rising substantially for relet contracts. Even before the 2020-21 Covid-19 pandemic hit, which drastically cut bus use leading to emergency funding, it was clear that to maintain supported services through conventional scheduled bus services was going to cost substantially more in coming years – while Council budgets were set to be increasingly squeezed. Initial modelling suggested that if a partner operator could provide booking and back office services, then DRT could significantly reduce the cost of the supported services while offering a better and more comprehensive service to users. With DRT largely seen as a niche rural areas measure, it was an innovative idea that it could be cost-effective for more lightly used urban services.

Milton Keynes Council were also progressing the electrification of public transport, having been part of the Arup/Arriva eBus project that trialled inductive charged buses in 2013-18 on a commercial route to prove their technical and economic viability (Miles and Potter 2014). They had secured further funding from the Department of Transport to procure more eBuses, but the operator was unwilling to take part in providing further electrified services. With DfT approval, the Council repurposed the eBus monies to provide a useful capital injection for the conversion of the supported bus services to DRT. Thus the Milton Keynes scheme had both start-up funding to support initial capital costs and ongoing funding by tapping into the established supported services budget.

The DRT Service in practice: *MK Connect*

Just as the implementation plans were being progressed, aiming at replacing Council supported services with DRT in 2020, the Covid pandemic hit. Despite enhanced support being available, as bus patronage collapsed one supported service operator withdrew. At very short notice, in October 2020, an initial DRT operation was introduced to the area previously served by the withdrawn scheduled service. This was run by Via and, conveniently, acted as a real life trial ahead of the replacement of 11 conventional Council supported services from April 2021. As is a legal requirement, the contract was the subject of a competitive tender, which Via won.

The Via contract is for an initial 3 years with reviews which allows the contract to be extended for a 4th and 5th year. It is a fixed price contract which replaces all but two conventional low-cost subsidised services. The previous cost of all contracted services in 2020-21 was £2.8m. For the following year, 2021-22, the total cost for *MK Connect* and the other two low cost contracted services is £1.9m. Had all the scheduled contracted bus services been renewed the costs were projected to be well above the 2020-21 level, even without the pandemic effect. A realistic comparison would be that the Milton Keynes DRT services were coming in at something like 60% of the cost of the scheduled services they replaced - possibly even less.

The form of contract for a DRT service compared to a contracted scheduled service involves important differences. A key issue about local authority contracts for DRT concerns what happens if demand rises requiring more vehicles and drivers to operate the service. The *Milton Keynes Connect* contract includes stringent KPIs (e.g. 30 minutes maximum time between booking and pickup for urban areas, 60 minutes for rural; 95% of journeys pick up within 10 minutes of booked time, 95% of journeys having a pickup within 400 metres of booking point etc.). The operator cannot reduce the quality of service if more vehicles and drivers are needed – they are contractually obliged to meet the KPIs. The contractual mechanism in Milton Keynes that addresses this situation is that Via retain the fare revenues. Thus, if demand rises, their income will also rise and this would provide the funds for more vehicles and drivers to be added. Indeed, this has already happened. The initial fleet was 13 electric and 5 wheelchair accessible diesel vehicles. This was to match the pandemic lockdown demand when the service was launch in April 2021. However, growth in passengers (and passenger income) has been such that by late May 2021, Via had added another two diesel vehicles to the *MK Connect* fleet and a further 6 have been ordered to enter service soon.

The service area for *MK Connect* is the whole of the unitary Borough of Milton Keynes, serving both its urban and rural areas (covering about 300 sq. km). The service is available Monday-Saturday 6am-11pm and 9am-6pm on Sundays, across the entire Borough. This is a considerable improvement on the service times of the conventional buses the DRT replaces, which operated at an hourly frequency in urban areas (two-hourly in rural areas), with little by way of an evening service and no Sunday service at all. The service is therefore far more inclusive, making possible trips that simply could not be made using the former scheduled routes, and operating at times and on days when previously there was no bus service at all.

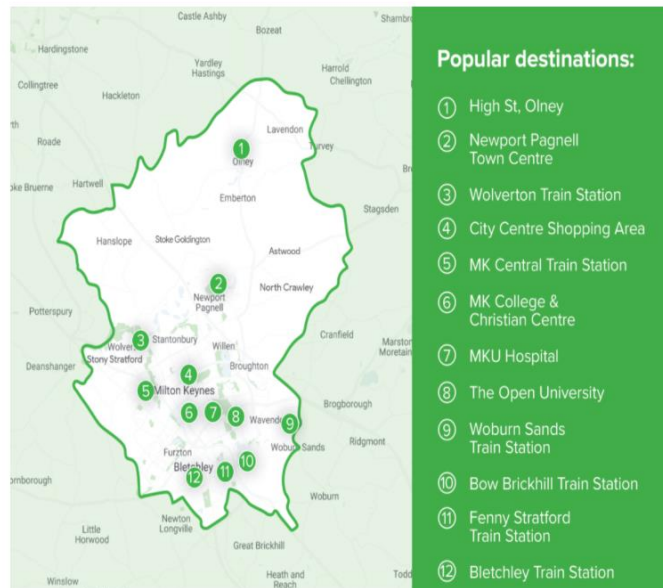


Fig 3: The MK Connect service area

Source: Via MK Connect website: ridewithvia.com/mk-connect/

The service is booked by users logging their pickup and drop off addresses through a smart phone app, web portal or (for senior concessionary pass holders only) phoning the contact centre. Electronic booking points at key bus stops to request a trip are also being installed. Payment is cashless via the app to a registered credit/debit card. The user is directed to a pickup point (which may be a bus stop or another nearby location) and told when the pickup will be. For urban areas the pickup is normally about 10 minutes after the booking is made at a point 150-250 metres from where they are, but this is longer for rural areas. The app allows the user to track their vehicle in real time, to know exactly when it will arrive.

Should the request be for a trip that matches a scheduled commercial bus route, the customer is directed to use this. The booking system algorithms can identify if a trip request is on a scheduled bus route and will direct the customer to use that; it will accept a trip request when that route is not operating (e.g. evenings or Sundays) and will also accept a booking if using the scheduled bus would require and excessive journey time (over an hour). Individuals can register special needs that inhibit them from using conventional buses; if this is done the booking system will allow any trip to be accepted.

That MK Connect does not compete with the scheduled services is a key part of the service design. Firstly, this is because it is illegal for council supported services to compete with commercial services; also, the strategic vision is that the introduction of *MK Connect* will strengthen public transport services as a whole. The expectation is that the DRT service will enhance the entire public transport system, which will eventually result in the sort of growth in use desired to achieve inclusive mobility and sustainable transport aims.

There is a flat fare for trips on *MK Connect*, which is £3.50 during peak hours (7am-9am, 4.30pm-6.30pm), £2.50 at all other times, £1 for *All in 1 MK* (youth and student) cardholders and free for Older Person's and Disabled Person's bus pass holders after 9.30am on weekdays and all day on weekends. These are comparable to existing bus fares, but there are presently no discounted weekly or monthly tickets. The bus fare levels and the various concessionary passes are crucial to *MK Connect* being a real public transport service. This has led to some concerns about the service being swamped by concessionary fare users, producing a slump in revenue, which would jeopardise the economic model (as outlined above, Via keep fares revenues and these are an important part of the viability of the service contract).

Limiting an individual's number of concessionary pass trips was considered, but in discussions with the Department for Transport it was established this would not be legal, so no limits have been imposed. In the first two months of service, although the use of free and discounted passes has been higher than for conventional buses, the level is manageable and does not threaten the economic viability of the service. Around 50% of trips are full fare, 25% at the youth concessionary rate of £1 and 25% senior free passes.

The services are operated with 8-seater vehicles under a Private Hire Vehicle Licence. Passengers can register special needs; those with a wheelchair or disability will always be matched with a fully accessible vehicle, and the service is accessible to passengers with vision and hearing impairments, as well as those with other additional needs. Closer pick-up and drop-off points are made for those who register substantial mobility limitations, and (as noted above) if the impairment inhibits them using scheduled services, their trip requests will be accepted even along an existing bus route.



Fig 4: An electric *MK Connect* vehicle

The 8-seater vehicles have a large boot that can take shopping bags, luggage, child buggies, smaller mobility scooters and folding bicycles.

In the first month, 25,000 new accounts were registered and *MK Connect's* operations involved 5,000 rides, with 65% of trips being in the electric vehicles. 100 trips were made in wheelchair accessible vehicles. The average wait time was 15.7 minutes from booking and the average walking distance to join the bus was 150 metres. In rural areas the walking distance was higher, but even so, 97% of all trips were within a 400 metre walking distance of the rider's starting point.

By the end of the second month (to 31st May), over 20,000 rides had been made with demand at that point was averaging 600 passengers a day (a rate of 18,000 trips a month. Demand was growing by about 20% a week, albeit from a low base as post lockdown social and economic activity resumed.

Discussion

The scoping study is ongoing and this paper is essentially work in progress. We are conducting the research in parallel with the service itself becoming established. Further interviews will take place with key informants representing DRT users in Milton Keynes. As the full service only started in April 2021, these interviews will not take place until this autumn, to allow the service to be 6 months in operation. Users will by then have been able to adjust to the new way of accessing and using this public transport system and be in a position to provide informed responses. We will also be investigating how understandings of *MK Connect* have evolved and how practices have developed to use it.

As noted in the Introduction to this paper, a number of studies had identified three sets of issues that needed to be addressed before DRT could become a viable service. These were the technology of providing DRT; how DRT relates to the regulation of bus services (which assumes conventional scheduled services) and the economic model of DRT services.

The technology has largely emerged from tech-based IT companies working for or within the taxi and private hire sector, and this can now be considered as established and reliable. For the Milton Keynes contract, a crucial element was that, under the annual fixed fee, the operator provides the entire service, including the booking and scheduling software and its operations. The contract also specifies that the software should be adapted to include key features for *MK Connect* to operate as part of the city's public transport system. This has included algorithms to direct requests to scheduled services when appropriate and allow users with special needs to log these and for the special needs to customise trip bookings (e.g. a so registered user to be allocated to a wheelchair accessible vehicle). The contract design is something that should

be of particular interest to other local authorities. Taking and modifying an existing commercial online system was crucial to making *MK Connect* economically viable. Perhaps not surprisingly, in Milton Keynes the modified design has had some initial glitches (some of which caused a certain amount of user frustration) but these are now being corrected.

The specifying of KPIs (and requiring their reporting to the Council) is also a crucial feature. This ensures that minimum standards are achieved and that the operator cannot reduce service quality in order to cut costs. The revenue retention mechanism to fund service expansion is also an important contract feature and is something that our research team intend to monitor to see if this fully succeeds. The proportion of trips made using discounted and free passes will also play a role in this. For conventional buses, which have ample off-peak capacity, free and discounted passes are not a particular issue. For DRT how such passes are used is far more important. If and how the use of these might be limited within a DRT service could be important (and something that would need some regulatory adjustments).

A further ticketing issue could have important transport policy implications. The *MK Connect* fare system only offers single trips and no day, week or monthly tickets are available. This is in contrast to the existing bus service fare structure in the Milton Keynes area (and elsewhere in the country) where such tickets are available, considerably reducing the cost to regular and frequent users. This situation is intended as a pragmatic interim arrangement which stems from the practicalities of setting up a radically new service.

The interviewees from Milton Keynes Council are aware that this ticketing structure means that, while *MK Connect* offers comparable priced tickets for single or day return trips, for frequent users (e.g. commuters), the *MK Connect* DRT is considerably more expensive than the conventional bus services it replaces. This issue is recognised by the Council who intend to introduce weekly/monthly tickets, but these may be restricted in some way in order to not substantially cut fares income. This difficulty in providing weekly/monthly tickets stem from the fact that the retention of fares income by the operator is an essential part of the *MK Connect* business model; discounted weekly and monthly passes would reduce net income. There is a dilemma here – to have an impact on car use and for people to make a lifestyle choice to rely on public transport services will probably need some form of loyalty reward – traditionally provided through discounted weekly and monthly passes. But, in the short term, the *MK Connect* business model depends on a high proportion of full fare uses providing a healthy revenue stream.

The above discussion has already touched upon implications for regulatory structures and systems. The issue of how DRT relates to bus service regulation is one that produced contrasting responses from our interviewees. Some felt that this was less of a concern than in the past, while others considered that it remained deeply problematic.

Government is increasingly aware that regulations need to reflect innovative public transport models, although little relating to this appears in the 2021 National Bus Strategy. However, there is an additional regulatory issue that, even if bus regulations are beginning to adapt to recognise DRT, they can exclude DRT schemes that operate outside of the Public Service Vehicle licence (PSV) structure. This is, perhaps, behind our contrasting views on regulatory challenges as the Milton Keynes DRT service has been implemented under Private Hire Vehicle (PHV) regulations. PHV regulations are intended for pre-booked cab services and, although they do permit shared bookings, are not envisaged as being a system under which public transport services operate.

Using PHV licensed vehicles does result in a real issue of the *MK Connect* service being ineligible for the Bus Service Operators' Grant (BSOG). It would also appear to be outside the scope of the emerging system set out the 2021 National Bus Strategy. The guidance to date indicates that DRT operating with PHV licence will not qualify as part of a Bus Service Improvement Plan (BSIP). This needs some clarification, but if so, is a major barrier as BSIP will be the major government funding stream for bus services (£3b per annum). A PHV DRT scheme may also fail to qualify for the new bus partnership funding if that also is restricted to PSV licensed services. Regulation has yet to reflect changes in public transport service designs, technology and operations. Whereas there used to be a clear distinction between bus services (PSV) and Private Hire Vehicle cab operations, DRT can take place under either licensing regime. A way to allow appropriate PHV DRT services to qualify is needed. This is an aspect that will be explored further in this study. One possibility would be to accept PHV

operations that are part of a local authority franchise/contract as being within an approved Bus Partnership). The additional funding that would unlock could then help ease the finance dilemma around discounted tickets for regular users.

These regulatory aspect lead into issues around the economic model for DRT, and this is where the greatest challenges remain. Introducing a fully commercially-viable DRT is difficult and it looks like the most viable way forward is going to be through partnerships between the new IT service companies, operators and local authorities (hence the importance of such partnerships receiving policy recognition). Where DRT can build upon an existing service base seems the most viable transition path as there is an existing income stream. In Milton Keynes this is for subsidised services. Another of the interviewees, having set up the Milton Keynes DRT, moved to a very different context, that of the West Midlands. Here there were different opportunities and constraints, but there were a number of subsidised transport services, one of which was suited to form the basis of a DRT system. This was the Ring and Ride specialist service for people with disabilities. Modernising this to form the basis of a wider DRT service is now being explored.

Marginally viable commercial services could also be the basis for a DRT partnerships with operators. Indeed, with the post-pandemic dip in bus patronage, there may be many local authorities in discussions with commercial operators about how to keep services running.

One crucial lesson is to avoid 'project' funding. That may work for a controlled trial to develop systems and build knowledge, understanding and confidence, but is not the basis for rolling out a permanent service. Projects rarely manage to 'kick start' a viable new service. One lesson from Milton Keynes is to introduce DRT to enhance an existing funded service. It can then get established and develop to address wider policy goals. A big mistake of many DRT projects has been to try to build a new user base around policy ideals that would take many years to develop. Such DRT services rarely managed to survive. Milton Keynes has built on council supported services, but other LA subsidised services could form the basis. The way in which Arriva Click are developing DRT represents another pathway - where using DRT to reconfigure commercial services enhances the profitability of that operator's system as a whole.

These various pathways suggest an eventual major change in the local public transport regime. An integration of DRT into local bus services can yield a considerable improvement in the quality provided, but does require users to learn and understand how it works. With its use of a real time booking app, *MK Connect* has many of the features of the more integrated MaaS vision frequently espoused as representing the public transport future. In this respect it can be seen as a practices/behaviours stepping stone towards that vision. Hence, monitoring the substantial change Milton Keynes users are facing in how local bus services are provided is of particular research interest. This situation is likely to be repeated around different implementation models in many other places, and so the lessons from Milton Keynes could have considerable value for DRT schemes elsewhere.

MK Connect: Key points for further investigation

To date this scoping paper has identified a number of issues raised by the MK Connect case study. Feedback on these issues, and other observations, are particularly welcome.

There are a group of issues around the design of the DRT system itself, which include:

- In terms of service design, the design of *MK Connect* has addressed most of the weaknesses of previous DRT attempts.
- It is a franchise model (like all supported services) as is advocated by the Bus Strategy.
- The franchise contract is structured around DRT metrics – as is specified in the KPIs
- It has established financial support and an established passenger base.
- The contract provides the financial flexibility required of a DRT service. This is significant and contains transferability lessons.
- The DRT franchise using the PHV system, bends the rules and in itself is viable, but institutional problems remain and need addressing. Could this be addressed in

different way (e.g. PHV operations that are part of a local authority franchise being accepted within an approved Bus Partnership).

A second set of issues are about how DRT relates to the broader transport system.

- The *MK Connect* DRT franchise forms part of an overall partnership approach with commercial scheduled services – this is distinctive. This is also advocated in the Bus Strategy (but in a narrower manner). The approach in Milton Keynes shows an approach that is far more transformative.
- It's 21st century service design, behaviours and practices – and as such could be a bridge to a MaaS-type offering.

A number of strategic policy implications have been identified.

- All bus service designs suit some users better than others. The conventional scheduled services that *MK Connect* replaced excluded a substantial number of trip types and people. Conventional bus services increasingly fail to provide for 21st century patterns of travel demand. The *MK Connect* service addresses this problem and the increased mobility options it provides can be expected to produce substantial social and economic benefits.
- But the form of this DRT model, while producing a high quality and economically viable service, might not address some trip types of key policy concern – in particular commuters and other regular users. Milton Keynes Council are aware of this issue and intend to address it.
- Assigning DRT to just a 'last mile' function limits its application to propping up an increasing failed bus service model. DRT can complement line buses in a far more sophisticated way to produce an overall network far more appropriate to 21st century patterns of travel.

Overall, *MK Connect* is an important approach to implementing DRT, which seeks to simultaneously achieve cost efficiency and transform service quality to make bus travel a viable option for a large segment of society. We will continue this study, which the authors believe represents an important contribution to enhancing the role of bus services in Britain's post pandemic recovery.

Acknowledgement

We wish to thank our initial set of interviewees whose responses, reflections and viewpoints have been incorporated into this paper.

References

Alonso-González, M. J., Liu, T., Cats, O., Van Oort, N., & Hoogendoorn, S. (2018) The potential of demand-responsive transport as a complement to public transport: An assessment framework and an empirical evaluation. *Transportation Research Record*, 2672(8), 879-889.

Bendixson, T., & Platt, J. (1992). *Milton Keynes: image and reality*. Granta Editions.

Calvert T, Ward S, Shergold I, Parkhurst G and Jaon J (2019) Business models being trialled in the shared-ride on-demand niche, and challenges and barriers encountered, *UTSG Annual Meeting*, Leeds, 8-10 July.

Department for Transport (2020) *Annual bus statistics 2019/20*, DfT, London, 28 October.

Department for Transport (2021a) *Bus Back Better: National Bus Strategy for England*. Department for Transport, 15th March.

Department for Transport (2021b) *Domestic Transport Use by mode since March 2020*. DfT, 3rd June, [Transport use during the coronavirus \(COVID-19\) pandemic - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic)

Geels, F. W. (2018) Low-carbon transition via system reconfiguration? A socio-technical whole system analysis of passenger mobility in Great Britain (1990–2016). *Energy research & social science*, 46, 86-102.

Haglund N, Mladenović M N, Kujala R, Weckström C, and Saramäki J (2019) Where did Kutsuplus drive us? Ex post evaluation of on-demand micro-transit pilot in the Helsinki capital region, *Research in Transportation Business & Management*, 32, forthcoming.

Hall P (2013) Refreshing the parts that other transport cannot reach. *Town and Country Planning*, March, 121–132.

LGA (2018) Nearly half of all bus routes under threat because of funding cuts to local government, *Local Government Association*. Available at <https://www.local.gov.uk/about/news/lga-nearly-half-all-bus-routes-under-threat-because-funding-cuts-local-government>

Marsden G, Dales J, Jones P, Seagriff E and Spurling N (2018) *All Change? The Future of Travel Demand and the Implications for Policy and Planning*. Commission on Transport Demand, London, UK.

Miles J and Potter S (2014) Developing a viable electric bus service: the Milton Keynes demonstration project. *Research in Transportation Economics* 48: 357–363.

Milton Keynes Council (2020): *Milton Keynes Strategy for 2050: Draft for Engagement*. Milton Keynes Council, January.

Perera S, Ho C and Hensher D (2020) Resurgence of demand responsive transit services – Insights from BRIDJ trials in Inner West of Sydney, Australia, *Research in Transportation Economics*, 83, forthcoming.

Pettersson-Löfstedt, F. (2019) An international review of experiences from on-demand public transport services. K2 working paper, available at: https://portal.research.lu.se/portal/files/65533516/An_international_review_of_experiences_from_on_demand_public_transport_services.pdf

Pettersson-Löfstedt, F. (2020) On-demand public transport-the future of public transport or the emperor's new clothes?. In *Handbook of Sustainable Transport*. Edward Elgar Publishing.

Potter, S. Warren, J. Valdez, A.M. and Cook, M: Towards an intelligent mobility regime, chapter 5 of Droege, P. (2021) *Intelligent Environments - Advanced Systems for a Healthy Planet*, Elsevier/Science Direct.

Sharmeen F, Drost D and Meurs H (2020) A business model perspective to understand intra-firm transitions: From traditional to flexible public transport services, *Research in Transportation Economics*, 83, forthcoming.

Sharmeen, F., & Meurs, H. (2019) The governance of demand-responsive transit systems—A multi-level perspective. In *The governance of smart transportation systems* (pp. 207-227). Springer, Cham.

Teal R F and Becker A J (2011) Business strategies and technology for access by transit in lower density environments, *Research in Transportation Business & Management*, 2, 57-64,

Veeneman, W., & Mulley, C. (2018) Multi-level governance in public transport: Governmental layering and its influence on public transport service solutions. *Research in Transportation Economics*, 69, 430-437